Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

LES of scalar transport in wave and wind-driven flows with large-scale structures CIGDEM AKAN, ANDRES E. TEJADA-MARTINEZ, University of South Florida, CHESTER E. GROSCH, Old Dominion University — Surface scalar (mass) transport results from large-eddy simulation (LES) of wind-driven flow with Langmuir circulation are presented. Wave-current interaction gives rise to Langmuir turbulence characterized by Langmuir circulation (LC) consisting of a spectrum of scales of counter rotating vortices roughly aligned in the direction of the wind. The typical crosswind length scale of the smallest observed vortices is on the order of several centimeters when the wind begins to blow over a quiescent interface and short capillary waves first appear. The crosswind length scale of the largest vortices reaches up to tens of meters under sustained winds and longer waves. Two different types of flows will be analyzed. The first type is characterized by small scale (centimeter scale) LC and the second type is characterized by large scale LC in shallow water where the cells span the entire water column. Both types of flows exhibit increases in surface mass transfer velocity (efficiency) due to the presence of LC. Statistical analysis of LES variables will be presented highlighting the differences between small-scale and large-scale LC structures and their impact on near-surface scalar transport.

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Date submitted: 09 Aug 2011 Electronic form version 1.4